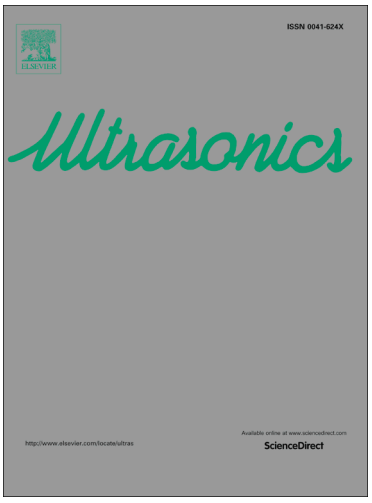

Receiver calibration and the nonlinearity parameter measurement of thick solid samples with diffraction and attenuation corrections

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Receiver calibration and the nonlinearity parameter measurement of thick solid samples with diffraction and attenuation corrections

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Abstract: This paper presents analytical and experimental techniques for accurate determination of the nonlinearity parameter (β) in thick solid samples. When piezoelectric transducers are used for β measurements, the receiver calibration is required to determine the transfer function from which the absolute displacement can be calculated. The measured fundamental and second harmonic displacement amplitudes should be modified to account for beam diffraction and material absorption. All these issues are addressed in this study and the proposed technique is validated through the β measurements of thick solid samples. A simplified self-reciprocity calibration procedure for a broadband receiver is described. The diffraction and attenuation corrections for the fundamental and second harmonics are explicitly derived. Aluminum alloy samples in five different thicknesses (4, 6, 8, 10, 12 cm) are prepared and β measurements are made using the finite amplitude, through-transmission method. The effects of diffraction and